Host selection and relative abundance of the Finger Fern *Grammitis billardieri* with regard to vegetation type at Mt Erica, Victoria

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Abstract
Despite the important role of vascular epiphytes in temperate rainforests, there are gaps in the literature regarding the factors driving their distribution patterns, including host tree specificity. This brief study attempts to determine the host preferences and relative abundance of the Finger Fern *Grammitis billardieri* (Willd.) in Cool Temperate Rainforest and Wet Sclerophyll Forest at Mt. Erica, Victoria. Both the type of host used and the relative abundance of the Finger Fern were significantly associated with vegetation type. The distribution of this species appears to be related to host characteristics, and therefore the conservation of this species will largely depend on the management of host tree populations, especially within the threatened temperate rainforest ecosystems. (*The Victorian Naturalist,* **125**, (5), 2008, 150-153)

There is little published knowledge regarding factors that affect the distribution and abundance of ferns, particularly smaller ferns, in temperate vegetation types . The Finger Fern *Grammitis billardieri* Willd. is a small (fronds <150 x 12 mm), epiphytic fern that occurs in moist, shady areas of southern Australia and New Zealand at altitudes between 100 and 1150 m. The Finger Fern commonly occurs on a range of living and dead tree species, but can also be lithophytic i.e. occur on rocks. The widespread decline of rainforest throughout Australia since late Cenozoic times has substantially impacted the distribution of this species, which is most abundant in these ecosystems. This study investigated (1) the range of host species used by *G. billardieri*, and (2) whether host selection and relative abundance of *G. billardieri* varied between Cool Temperate Rainforest (CTR) and Wet Sclerophyll Forest (WSF).

Data was collected from pockets of CTR and WSF at Mt Erica in Baw Baw National Park. Three north-south transects were sampled in each of the vegetation types, with each transect separated by at least 10 m. Each transect was sampled for 40 minutes, with the host type and abundance of the Finger Fern (n=<10, 10-50, >50) recorded wherever it occurred along each transect. The boundary between CTR and WSF was determined by the presence of Mountain Ash *Eucalyptus regnans* F. Muell., which signified a transition into WSF. A transition zone of 20 m between the two vegetation types was not sampled.

Grammitis billardieri were recorded at 115 points along the transects, 46 times in WSF, and 69 times in CTR (Fig. 1). Six different hosts were used by the plant, both organic hosts (live and dead trees) and non-organic hosts (boulders). Both Mountain Ash and Mountain Correa *Correa lawrenceana* Hook. occurred only in the WSF, and so were excluded from the statistical analyses.

The hosts used by *G. billardieri* in this study were similar to those found in published literature. Gullan and Walsh (1986) stated that the Finger Fern was found on 'rocks, logs, or trunks of trees and tree-ferns'. Kellar *et al.* (2006) found the fern on both Myrtle Beech *Nothofagus cunninghamii* (Hook.) Oerst., and Mountain Ash. Wakefield (1975) reported the fern occurring on rocks, logs and tree-ferns, but noted that they occurred more often on the mossy trunks of Myrtle Beech, Kanooka *Tristaniopsis laurina* Sm. and Sassafras *Atherospermum moschatum* Labill. The lack of fern presence on Kanooka in this study was due to a lack of this species in the study area. Sassafras did occur in the area, but not along the transects investigated.

That no *G. billardieri* was recorded growing on tree-ferns was surprising, considering their known suitability as Finger Fern hosts. However, not only were there few tree-ferns along the transects, but those that were pre-

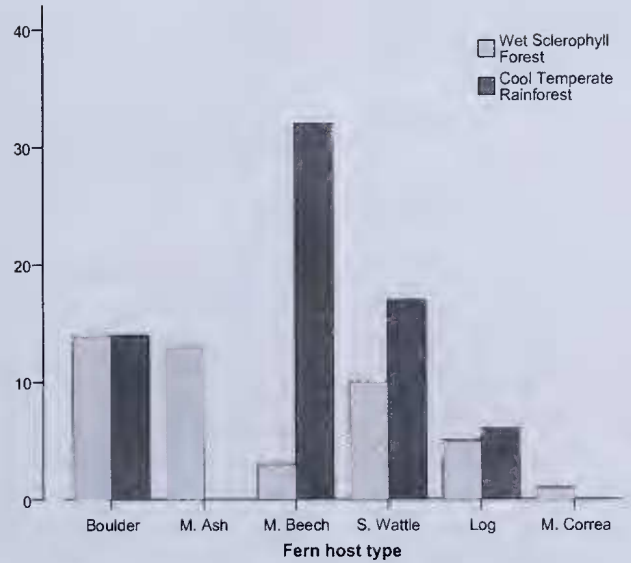

Fig. 1. The occurrence of *Grammitis billardieri* on different hosts in Wet Sclerophyll Forest (n=46) and Cool Temperate Rainforest (n=59) at Mt Erica. (Sampling effort = 40 minutes in each vegetation type).

sent were predominantly short (< 2 m). Short tree-ferns are known to have fewer epiphytes than taller ones, due to the skirt formed by old fronds preventing light and rain from entering the upper region of the trunk (Page and Brownsey 1986; Ford and Gibson 2000; Floyed and Gibson 2006).

There was a significant association between the vegetation type and the host species used by the Finger Fern (χ^2 =14.299, df =3, p =0.003). The occurrence of the fern in rainforest was equal to or greater than the occurrence in forest for all of the host types (Fig. 1). The very distinct difference in Myrtle Beech use as a host between vegetation types suggests that this host-use difference has biological significance.

These results suggest that the suitability of some hosts for the Finger Fern may change with respect to the vegetation type the host is located in. Logs and boulders, which occurred in similar proportions in both WSF and CTR, had almost exactly the same occurrence of the target species. None of the published literature on *G. billardieri* (Parris 1975; Wakefield 1975; Parris 1983; Gullan and Walsh 1986) indicates a preference for rocks or logs, in either vegetation type, and therefore they are believed to offer similar opportunities for colonisation by the fern. This suggests that the differences recorded in Myrtle Beech and Silver Wattle use are probably driven more by variation in the host tree characteristics than by broad environmental variables among the vegetation types. This is similar to results from other studies (e.g. Callaway *et al.* 2002; Munoz *et al.* 2003; Mehltreter *et al.* 2005; Laube and Zotz 2006a; 2006b), which show colonisation by vascular epiphytes correlated to specific host tree attributes, including tree size and bark characteristics.

There was a higher occurrence of *A. dealbata* as a host in the CTR, although it was relatively common in both vegetation types within the study area. While *N. cunninghamii* occurred in higher numbers in the CTR, it had a substantial presence in the WSF, especially in the areas close to the rainforest. The use of *N. cunninghamii* as a host was more than an order of magnitude greater in the CTR, which strongly suggests that factors other than chance are

responsible for its increased utilisation as a host. This apparent 'preference' for *N. cunninghamii* as a host in CTR is supported by Wakefield (1975), who noted a higher occurrence of *G. billardieri* on the trunk bases of some trees, including Myrtle Beech, than on logs, rocks or tree-ferns in rainforest ecosystems.

The difference in host use between CTR and WSF is probably due to an interaction of host factors (e.g. bark properties and tree size), with a lesser effect from environmental variables, including moisture levels and light-related factors (Callaway *et al.* 2002; Munoz *et al.* 2003; Mehltreter *et al.* 2005; Laube and Zotz 2006a). Callaway *et al.* (2002) found that water-holding capacity of the host's bark highly correlated with the presence of epiphytic ferns. However, they also found that while some ferns are particularly associated with specific host species, host traits favouring colonisation did not fully explain this relationship. It may well be that *N. cunninghamii*, for example, has bark properties (i.e. water-holding capacity) favouring establishment of the Finger Fern in CTR; however, the decrease in moisture in WSF results in other physical properties exerting greater influence on colonisation.

Because our study measured only the relative abundance of ferns, and not that of the host species, quantitative analysis of the changing proportions of host colonisation is imprecise. Knowing exact ratios of colonisation for the different hosts would assist in detecting further changes in host suitability between CTR and WSF.

There was a significant association between the vegetation type and the abundance of the Finger Fern (χ^2 =21.763, df =2, p <0.001). The WSF had a slightly greater occurrence of *G. billardieri* at low abundance, substantially less at a medium abundance, and no occurrence at high abundance (Fig. 2).

Our results showed that the relative abundance of *G. billardieri* differed significantly between the WSF and the CTR, with substantially greater occurrence in the 10-50 and >50 abundances in the CTR. This highly significant difference (p<0.001) indicates that factors other than chance are driving the relative abundance of the Finger Fern at Mt Erica.

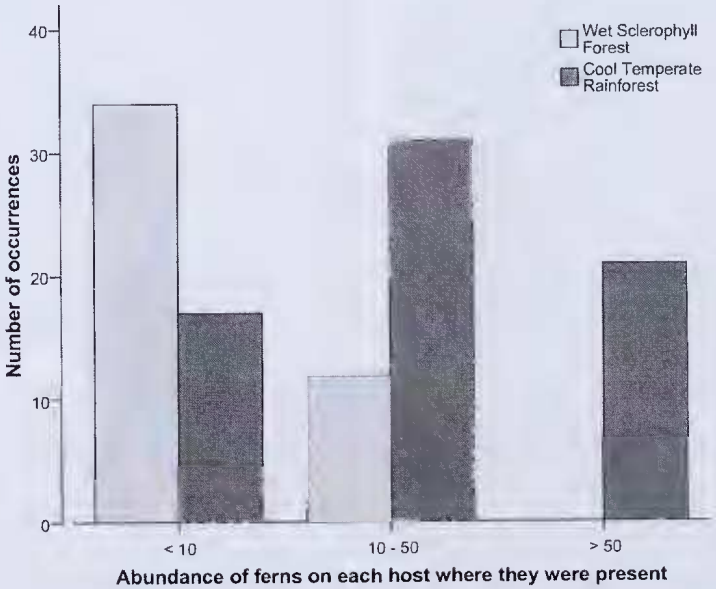

Fig. 2. The occurrence of *Grammitis billardieri* at different abundances in Wet Sclerophyll Forest (n=46) and Cool Temperate Rainforest (n=69) at Mt Erica.

Factors likely to be responsible for the increase in relative abundance in CTR include: increased levels of moisture and humidity (Callaway *et al.* 2002; Lobel *et al.* 2006), more favourable conditions of the substrate, such as higher water-holding capacity (Mehltreter *et al.* 2005), and vegetation-driven variables such as light attenuation through the canopy (Callaway *et al.* 2002).

While this study did not incorporate host size parameters, tree size is likely to have an effect on the abundance of epiphytic ferns, due to increased surface area, accumulation of epiphytes through time, and changes in bark characteristics (Zimmer-man and Olmsted 1992; Munoz *et al.* 2003). Laube and Zotz (2006a) suggested that population dynamics of vascular epiphytes, especially dispersal-related factors, were responsible for the greater recruitment on larger hosts. Similarly, Lobel *et al.* (2006) found that the age of host trees (generally linearly associated with size) affected the dispersal and metapopulation dynamics of epiphytic ferns, with a general increase in species richness with increased age.

Conclusion

The presence of the Finger Fern on hosts in CTR and WSF was not a random occurrence; however, specific host selection between these vegetation types was not determined. Host tree selection by *G. billardieri* in CTR and WSF may well be a reflection of the changing environmental gradients that drive the distinction between these vegetation types.

When considered together, the differential use of hosts between vegetation types, and the substantial increase in relative abundance in CTR, indicate that the Finger Fern requires specific vegetation and environmental conditions to thrive. These conditions are the most favourable in areas of undisturbed Cool Temperate Rainforest, and therefore planning for the conservation of this species should centre on further protection of these rainforests in southern Australia.

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